Active Project (2014 - 2017)

High Capacity Cryocooler (2020 Cooler) Project

Game Changing Development Program | Space Technology Mission Directorate (STMD)

ANTICIPATED BENEFITS

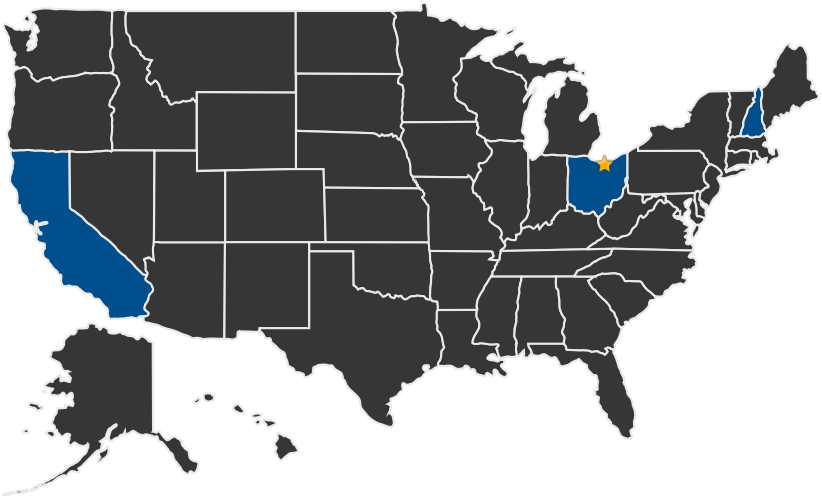
To NASA funded missions:

Future exploration missions beyond Low Earth Orbit will require long-term (>2 weeks) in-space storage of large quantities (>4 metric tons) of Liquid Hydrogen without a significant loss of propellant due to boil off from radiation heat sources.

DETAILED DESCRIPTION

Advance the TRL of a 20W 20K cryocooler for use within a NASA future-defined Liquid Hydrogen Zero Boil Off test

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

- Creare, LLC (Hanover, NH)

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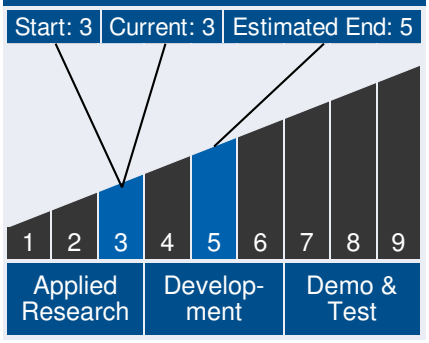
Technology Maturity



Management Team

Program Executive:

- Lanetra Tate

Program Manager:

- Mary Wusk

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High Capacity Cryocooler (2020 Cooler) Project

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Management Team *(cont.)*

Project Manager:

- Michael Doherty

Principal Investigator:

- Molly Anderson

Technology Areas

Primary Technology Area:

In-Space Propulsion Technologies (TA 2)
- Supporting Technologies (TA 2.4)
  - Propellant Storage and Transfer (TA 2.4.2)
    - Active Thermal Control (TA 2.4.2.2)

Human Exploration Destination Systems (TA 7)
- Human Mobility Systems (TA 7.3)
  - EVA Mobility (TA 7.3.1)
    - Advanced Airlock/Suitlock (TA 7.3.1.6)

Secondary Technology Area:

Launch Propulsion Systems (TA 1)

Materials, Structures, Mechanical Systems and Manufacturing (TA 12)

In-Space Propulsion Technologies (TA 2)
- Supporting Technologies (TA 2.4)

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Technology Areas *(cont.)*

Materials, Structures, Mechanical Systems and Manufacturing (TA 12)
- Materials (TA 12.1)
  - Flexible Material Systems (TA 12.1.3)
- Structures (TA 12.2)
  - Lightweight Concepts (TA 12.2.1)
- Mechanical Systems (TA 12.3)
  - Deployables, Docking, and Interfaces (TA 12.3.1)

Thermal Management Systems (TA 14)
- Cryogenic Systems (TA 14.1)
  - Active Thermal Control (TA 14.1.2)
    - High Capacity 20 Kelvin Cryocoolers (TA 14.1.2.1)
    - High Capacity 90 Kelvin Cryocoolers (TA 14.1.2.2)
    - Integrated Radiator/Cryocooler for Liquefaction (TA 14.1.2.7)

DETAILS FOR TECHNOLOGY 1

Technology Title

High Capacity Cryocooler

Technology Description

This technology is categorized as a hardware subsystem for ground scientific research or analysis

High Capacity Cryocooler (2020 Cooler) Project

The 20 Watt, 20 Kelvin cryocooler utilizes the reverse turbo-Brayton thermodynamic cycle to cool helium working gas at cryogenic temperatures, circulated through a distributed network for discrete or broad area cooling, having the potential to achieve zero (or near zero) boil-off storage of space-based of liquid hydrogen.

Capabilities Provided

On-orbit, long duration storage of liquid hydrogen

Potential Applications

Space Launch System (SLS) Exploration Upper Stage (EUS)